Response to reviewer 1

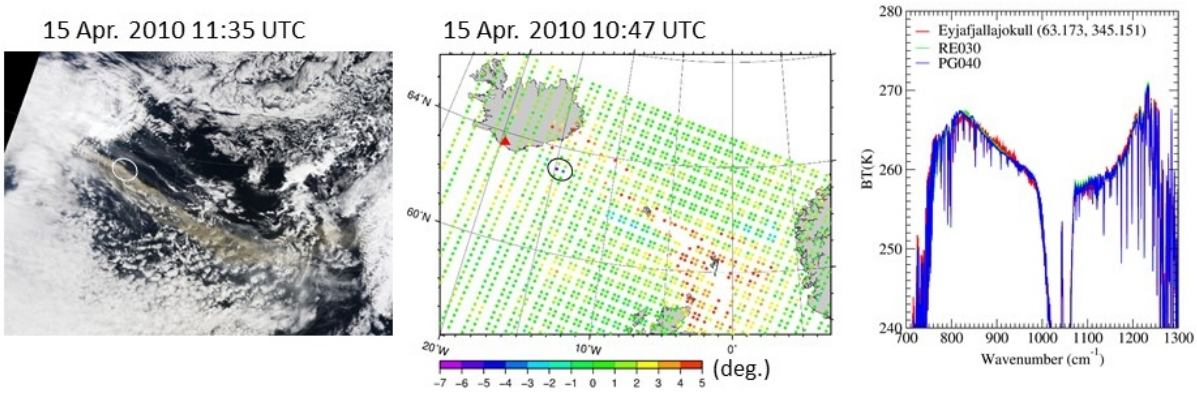
Thank you very much for the useful comments. In the revised manuscript, we tried to follow the reviewer's comments. Responses for the comments are addressed below.

1. It would be worthwhile (for completeness) to include salient details of IASI. For example, the pixel size, wavenumber range, wavenumber interval an NEDT (@240K) would be useful. A sentence will do.

⇒ IASI specification was added at the end of Sec 1 (L 70-73). To follow the 2nd reviewer, a figure (Fig.1) for a comparison between line-by-line and our RT code (MBCRM) for clear sky atmosphere was added. IASI NEDT@280K is also plotted in this figure.

2. A good test of this procedure might be to study an eruption cloud that changed composition over the time period of the eruption. I think this happened with Eyjajfallajokull 15 April eruption and there may be other examples.

⇒ To follow the reviewer's comment, the ash clouds of Eyjajfallajokull on 15 April were investigated. We found two IASI pixels that satisfy our retrieval conditions. The best fit RI models were PG040 (NBO/T=0.4) of Prata et al. (2019) and RE030 (Eyjajfallajokull_a) of Reed et al. (2018). In the results of our analysis, composition of Eyjajfallajokull ash of 15 April was similar to those of 6-12 May. Results of RMS and retrieved VAC parameters were added to the end of the supplement files (S1, S2).



3. Table 3 is an excellent addition to the literature as this could provide a much-needed

benchmark for comparison with other retrieval schemes. Accepting that this retrieval (and others) are not "truth", having a small and manageable data-set like this is still of immense value.

⇒ A data-set of brightness temperature spectrum (BTS) in the figures in Table 3 was uploaded as supplementary material (S3). The caption of Table 3 was modified. We eliminated the parts for Bezymianny, Rinjani, Sarichev_peak, and Zhupanovsky from the revised manuscript to follow the comments of the 2nd reviewer.

4. It would be interesting to know if the RI models have any effect on the wavenumber interval 1300-1400 cm^-1 where there is another SO2 absorption which is usually considered unaffected by ash.

⇒ The contribution of ash particles to the brightness temperature on the wavenumber interval 1300-1400 cm-1 is not negligible. As shown in Figs 3-5, however, the dependence on ash RI model is relatively small. In this reason, we estimated SO2 contents only by using brightness temperature at wavenumber $1320\ \mathrm{cm}^{-1} \leq \nu \leq 1395\ \mathrm{cm}^{-1}$.

5. It is not entirely clear to me from Fig.7 how reff and composition are changing the spectra. Maybe the spectra could be plotted as differences to make it clearer. For example, does changing reff while keeping the RI model the same alter the "shape" and/or magnitude of the spectra? Similarly, does changing the RI model for the same reff alter the "shape" and/or magnitude of the spectra?

⇒ The figures were replaced (Fig.11d and 11e), and some sentences were modified.

6. Suggestion: it might be quite informative to plot the compositions of the example volcanoes used on a TAS diagram.

⇒ A TAS diagram was added as Fig. 7. We replaced compositional data of Nishinoshima for 2020 eruptions because we found a new reference. Same sentences were also added in Sec.5.4.